PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-078293
(43)Date of publication of application : 18.03.1994

(51)Int.Cl. H04N 7/137
G06F 15/66
H03M 7/30

(21)Application number : 04-229978
(22)Date of filing : 28.08.1992

(71)Applicant : OLYMPUS OPTICAL CO LTD
(72)Inventor : YAMADA HIDETOSHI

(54) CODER

(57)Abstract:
PURPOSE: To allow the coder to freely convert data of a different system and to attain editreproduction and recording to a shared medium or the like.
CONSTITUTION: An IVLC circuit 2 receiving an animation signal coded as a consecutive still picture from an input terminal decodes the received animation signal as a still picture and a data memory 3 stores the decoded signal. Then a code quantity prediction circuit 12 implements inter-frame prediction based on animation coded information and still picture informationand a VLC circuit 13 applies coding to the animation by inter-frame compression.

CLAIMS

[Claim(s)]
[Claim 1]Coding equipment comprising:
A moving picture input means to input a dynamic image signal coded as a continuous still picture.
A decoding means which decodes a dynamic image signal inputted into the above-mentioned moving picture input means as a still picture.
Video encoded information inputted by the above-mentioned moving picture input means.
An encoding means which performs inter-frame prediction based on still picture information decrypted by the above-mentioned decoding meansand performs coding by inter frame compression of video.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the coding equipment which compresses datain order to perform recordtransmissionetc. to the picture and audio signal which were digitized.
[0002]
[Description of the Prior Art]When considering it as digital datarecording and transmitting a picture conventionallythe data volume will become hugeand in order to record in the range of the storage capacity to which the picture information of these many was restrictedit needs to perform a certain compression to a picture signal. And as compression technology of highly efficient image datathe encoding method which combined orthogonal transformation and variable length coding is known widely. For examplethe outline of the JPEG system currently examined as international standards of still picture compression technology is as being shown below. Firstimage data is divided into the block which consists of a pixel of 8x8and a two-dimensional discrete cosine transform (DCT) is performed as orthogonal transformation for this the divided block of every.
[0003]As a resultimage data is changed into a dc component and an alternating current componentand on the matrix of 8x8Alternating current component data AC07 dc-component DC indicates the maximum frequency value of a lateral axis direction to be to a position (07) to a home position (00)Alternating current component data AC77 alternating current component data AC70 which shows the maximum frequency value of a longitudinal axis direction indicates the maximum frequency value of an oblique direction to be to a position (77) is stored in a position (70)respectively.
[0004]Nextlinear quantization according to each frequency component is performedand Huffman encoding is performed as variable length coding to this quantized value. At this timeHuffman encoding of the difference value with the dc component of a block will be carried out about a dc component soon.
[0005]And an alternating current component performs the scan to the low high frequency component called a zigzag scan from a frequency componentand performs Huffman encoding to the group of the number which the ingredient of invalidity (a value is "0") followsand the effective value following it. When compressing an animationit can compress by coding with the method previously described to each top as continuation of a still picture (i.e.an animation).
[0006]The MPEG system is examined as international standards as on the other hand more highly efficient animation compression technology. In this methodthe compression in a frame which is compression as a still pictureand the inter frame compression which is compression using continuous inter-frame prediction are combined. And in the compression in a frameit codes combining conversion into dc and variable length coding like a JPEG system which was described previously fundamentally.

[0007]The frame which performs compression as such a still picture is called a core frameand is arranged at the suitable interval for inter-frame [continuous]. And such a frame is called I picture.
[0008]And in inter frame compressionfrom a nearby reference framea predicted value is computed and the difference of the frame which it is going to codeand its predicted value is coded combining conversion into dc and variable length coding. In order to calculate a predicted value from a nearby framedetecting and predicting a motion of a screen is performed. That isthe physical relationship which is most alike for every block of a predetermined size in a reference frame and a coding frame is searched forand let the position gap be a motion vector. This motion vector is also coded as some numerals. Three kinds of prediction proceduresthe forward prediction by the past framethe backward prediction by the frame of the futureand also both average value predictioncan be considered as the methodi.e.motion compensation frame predictionusing the frame of not only the past frame but the future as a reference frame.
[0009]Thusin the MPEG systemthe frame which chooses and uses the optimal prediction out of three predicted valuesthe frame by forward predictioni.e.P pictureforward prediction and back forward predictionand both average value predictioni.e.B pictureis used. It not only can apply distinction of the above-mentioned IPand B picture to all the framesbut it is applicable for every macro block in a frame.
[0010]
[Problem(s) to be Solved by the Invention]As mentioned abovethere is a method which combined the method coded as continuation of a still picture as compression technology to videoand the compression in a frame and inter frame compression.
[0011]Comparatively simplythe former is used for a small portable device like a recorder integral-type video camera by coding equipment although efficiency is not highand the latterAlthough it has the advantage that highly efficient coding is possible although an equipment configuration becomes complicatedand used by non-portable apparatusa computeretc.each coding mode can process neither direct reproduction nor edit to the data in which it differs and methods differ.
[0012]Although the multimedia which can treat freely the information on varietiessuch as a picture signal and an audio signal besides text dataon a personal computer is usedIn such a devicea certain top in the picture which it was desirable that the video coded by the method of a still picture or a variety as a picture can be treated freelyfor exampleit coded as an animation is sampled as a still pictureand it asks also for processing which is recorded [which record and is edited] and reproduced.
[0013]This invention was made in light of the above-mentioned problemsthe place made into the purpose can carry out data conversion freely also to the data of a different methodand it is in performing editreproductionrecord to a common mediumetc.
[0014]

[Means for Solving the Problem]To achieve the above objectsin coding equipment of this invention. A moving picture input means to input a dynamic image signal coded as a continuous still pictureA decoding means which decodes a dynamic image signal inputted into the above-mentioned moving picture input means as a still pictureAn encoding means which performs inter-frame prediction based on video encoded information inputted by the above-mentioned moving picture input means and still picture information decrypted by the above-mentioned decoding meansand performs coding by inter frame compression of video is provided.
[0015]
[Function]Namelyif the coding equipment of this invention inputs the dynamic image signal coded as a still picture in which a moving picture input means continuesThe video encoded information as which the decoding means decoded the dynamic image signal inputted into the above-mentioned moving picture input means as a still pictureand the encoding means was inputted by the above-mentioned moving picture input meansInter-frame prediction is performed based on the still picture information decrypted by the above-mentioned decoding meansand the coding by the inter frame compression of video is performed.
[Example]Firstthe principle of this invention is explained in advance of explanation of an example.
[0016]Since the picture which consists only of an I picture is generally also accepted in the MPEG standardWhat is necessary is just to use within a frame a discrete cosine transform (DCT) and the numerals by which entropy code modulation was carried out as it isand to make only a format agree to each standard in the easiest conversion method.
[0017]Howeversince inter-frame compression is not performedwhen compression has a limitfor examplea data transfer rate has a limit like a magneto-optical discit is necessary to perform inter-frame compression and to raise a compression ratio by this method.
[0018]By this methodsince a mass memory is neededan equipment configuration will be complicatedthe information coded by the compression in a frame is once decrypted altogetherand recoding this using inter frame compression anew is consideredand a conversion time will also become long.
[0019]Thenthe coding equipment of this invention notes that DCT of the object image signal has already been carried out****** [judging whether the block which processes has a high order conversion factorand performing any of the formation of a frame inner codeand interframe coding according to the result] -- or it has the feature to determine whether perform processing which asks for a motion vector. Hereafterthe example of this invention using such a principle is described.
Drawing 1 is a figure showing the composition of the coding equipment concerning the 1st example of this invention.
[0020]As shown in the figurethe input terminal 1 is connected to the IVLC circuit 2and this IVLC circuit 2 is connected to the data memory 3. And this data memory 3 is connected to the inverse quantization IDCT circuit 4 and the coefficient decision circuit 6.

[0021]The above-mentioned inverse quantization IDCT circuit 4 is connected to the buffer memory 5 and the difference decision circuit 7and this buffer memory 5 is connected to the motion vector calculation circuit 8. And the above-mentioned motion vector calculation circuit 8 is connected to the selector 9and this selector 9 is connected to the subtractor circuit 10.
[0022]And this subtractor circuit 10 is connected to the DCT quantization circuit 11and this DCT quantization circuit 11 is connected to the code amount prediction circuit 12. This code amount prediction circuit 12 is connected to the VLC circuit 13and this VLC circuit 13 is connected to the DCT quantization circuit 11.
[0023]In such compositionif the dynamic image signal compressed into the input terminal 1 in the frame is inputtedthe IVLC circuit 2 will decrypt the data of Huffman coding etc. by which variable length coding was carried outand the data memory 3 will store this decrypted data. And this quantized DCT coefficient is changed into a central valueand also the inverse quantization IDCT circuit 4 performs reverse DCT transformationand restores image dataand the buffer memory 5 accumulates this restored image data.
[0024]It judges whether the DCT coefficient of each block of the coefficient decision circuit 6 has a high order ingredientand the difference decision circuit 7 asks for the motion vector between adjacent frames. And it chooses whether the selector 9 performs inter-frame difference processing based on a DCT coefficient and a difference decision resultand the subtractor circuit 10 performs inter-frame difference processing.
[0025]And image data performs DCT as orthogonal transformation for every blockand the DCT quantization circuit 11 performs linear quantization using the quantization width for every frequency component further set up beforehand for every frequency component. And the VLC circuit 13 performs variable length codingsuch as Huffman encodingto the quantized DCT transformation coefficientthe code amount prediction circuit 12 computes the generated code amount of the frame codedand quantization width is set up based on this. Nextdetailed operation of the coding equipment of this example is explained. For exampleHuffman coding will be decrypted by the IVLC circuit 2 if the moving image signal coded using the compression in a frame with the camcorder is inputted into the input terminal 1.
[0026]And this decrypted data is recorded on the data memory 3and the DCT coefficient quantized in the inverse quantization IDCT circuit 4 is changed into a central valuereverse DCT transformation is performedand image data is restored. And this restored data is recorded on the buffer memory 5.
[0027]Evaluation of the data which evaluation of the DCT coefficient currently recorded on the above-mentioned buffer memory 5 by the coefficient decision circuit 6 is performedand is recorded on the above-mentioned buffer memory 5 by the difference decision circuit 7 is performedand it opts for subsequent coding processing. The method of this coding processing is explained with reference to drawing 2.

[0028]In the microprocessor Am and Bm to which the newest frame A and the frame B in front of one correspondThe Am itself is formed into a frame inner code when one side of Am and Bm has a high order conversion factor when Am and Bm have only a conversion factor of the low next (i.e.when all high order coefficients are "0")and another side has a conversion factor of the low next. And the Am itself is formed into a frame inner code when the difference (for examplesum of squares of the difference of each pixel) of the data decrypted when Am and Bm had a high order conversion factor is larger than a threshold.
[0029]In being smaller than a thresholdthe difference of Am and Bm is coded and it detects a motion vector. And in the judgment of a conversion factorit considersfor example that a DC component01 ingredients of ACten ingredients of ACand 11 ingredients of AC are the coefficients of the low nextand let more than it be a high order coefficient. Coding is performed in accordance with such a standard.
[0030]And when Am and Bm have only a conversion factor of the low nextthe data of Am and Bm currently recorded on the buffer memory 5 is inputted into the subtractor circuit 10 via the selector 9and difference (Am−Bm) is calculated.
[0031]And DCT is performed by the DCT quantization circuit 11 to this obtained difference dataand linear quantization is further performed using the quantization width beforehand set up for every frequency component. Huffman encoding of the DCT transformation coefficient quantized by the VLC circuit 13 is carried outand it serves as coding data.
[0032]When one side of Am and Bm has a high order conversion factor and another side has only a conversion factor of the low nextAnd when the difference of the data in which Am and Bm were decrypted with the high order conversion factor is larger than a thresholdthe DCT transformation and the quantized data of Am memorized by the data memory 3 are sent to the VCL circuit 13and Huffman encoding is carried outand it turns into coding data.
[0033]And Am and Bm have a high order conversion factorwhen the difference of the decrypted data is smaller than a thresholdthe data of Am and Bm which are recorded on the buffer memory 5and its neighborhood block is inputted into the motion vector calculation circuit 8and a motion vector is searched for. And Bm predicted using this Am and the acquired motion vector is inputted into the subtractor circuit 10 via the selector 9and difference is calculated.
[0034]Linear quantization is performed using the quantization width to which DCT transformation was performed by the DCT quantization circuit 11and this obtained difference data was further set beforehand for every frequency component. Huffman encoding of the DCT transformation coefficient quantized by the VLC circuit 13 is carried outand let it be coding data. Herethe code amount prediction circuit 12 computes the generated code amount of the frame codedquantization width is set up based on thisand conversion of coding data is performed in this way.
[0035]As explained abovein the coding equipment concerning the 1st example. By judging coding mode of processing using the data formed into the frame inner

codeand the decrypted datasince it is carried out only on the limited conditions with calculation of the motion vector which is complicated data processingit can process efficiently. Nextthe coding equipment concerning the 2nd example that processes to the image data picturizedfor example by the electronic "still" camera is explained.

[0036]Hereit has a function which photos a picture continuously although an electronic "still" camera is originally apparatus which photos a still pictureand the device which can photo about per second 20 tops is developed. Such a continuous-shooting picture can be used as a false animation by performing frame interpolation. Although there are some which are equipped with the mechanism which can add voice data as attendant information to a picture in an electronic "still" camerathis data can also be used as voice data of coded dynamic image data. Drawing 3 is a figure showing the composition of the coding equipment concerning the 2nd example.

[0037]This example has the composition of having provided the interpolation circuit 14 further in the composition of the 1st example of the above. And this interpolation circuit 14 is characterized by searching for the picture which buries the top between the still pictures by which continuous shooting was carried out with techniquessuch as linear interpolation. Hereafteroperation of the coding equipment concerning this example is explained.

[0038]For exampleHuffman coding will be decrypted by the IVLC circuit 2 if the continuous-shooting picture signal which was picturized by the electronic "still" camera and coded by the JPEG system is inputted into the input terminal 1. And this decrypted data is recorded on the data memory 3and the DCT coefficient quantized in the inverse quantization IDCT circuit 4 is changed into a central valueand also reverse DCT transformation is performedand image data is restored.

[0039]And this restored data is recorded on the buffer memory 5. And evaluation is performed by the difference decision circuit 7 to the data recorded on the buffer memory 5 by the coefficient decision circuit 6 again to the DCT coefficient currently recorded on the data memory 3and it opts for subsequent coding processing. That isin the micro block Cm and Dm to which the newest top C and the top D in front of one correspondwhen Cm and Dm have only a conversion factor of the low next (i.e.when all high order coefficients are "0")difference with Cm and Dm is coded and detection of a motion vector is not performed.

[0040]And the Cm itself is formed into a frame inner codewhen one side of Cm and Dm has a high order conversion factor and another side has only a conversion factor of the low next. The Cm itself is formed into a frame inner code when the difference (for exampleabsolute value sum of the difference of each pixel) of the data decrypted when Cm and Dm had a high order conversion factor is larger than a threshold. In being smaller than a thresholdit codes the difference of Cm and Dmand a motion vector is detected.

[0041]Coding is performed according to the above-mentioned standard. And the data of Cm and Dm currently recorded on the buffer memory 9 when Cm and Dm have only a conversion factor of the low next is inputted into the subtractor

circuit 10 via the selector 9and difference is calculatedFurthermore the value of the half of a difference value is calculated by the interpolation circuit 20and it becomes an interpolation frame as shown in drawing 4. And DCT is performed by the DCT quantization circuit 11 andas for the obtained datalinear quantization is performed using the quantization width beforehand set up for every frequency component. Huffman encoding of the DCT transformation coefficient quantized by the VLC circuit 13 is carried outand it serves as coding data.

[0042]And when one side of Cm and Dm has a high order conversion factor and another side has only a conversion factor of the low nextAnd Cm and Dm have a high order conversion factorand when the difference of the decrypted data is larger than a thresholdThe DCT transformation of Cm memorized by the data memory 3 and the quantized data are sent to the VLC circuit 13Huffman encoding is carried out and it becomes coding dataand the DCT transformation and the quantized data of Dm are sent to the VLC circuit 13 as interpolation dataand Huffman encoding is carried outand it turns into coding data.

[0043]Cm and Dm have a high order conversion factorit is decryptedand when the difference of data is smaller than a thresholdthe data of CmDmand its neighborhood block currently recorded on the buffer memory 5 is inputted into the motion vector calculation circuit 8and a motion vector is searched for. Dm predicted using this Cm and the acquired motion vector and the interpolation frame predicted using one half of the obtained values of a motion vector are inputted into the subtractor circuit 10 via the selector 9and each difference is calculated.

[0044]And DCT is performed by the DCT quantization circuit 11 andas for this obtained difference datalinear quantization is performed using the quantization width further set up beforehand for every frequency component. Huffman encoding of the DCT transformation coefficient quantized by the VLC circuit 13 is carried outand let it be coding data. And the code amount prediction circuit 12 computes the generated code amount of the frame codedand quantization width is set up based on this. Nextthe handling of voice data is explained with reference to drawing 5 and drawing 6.

[0045]In drawing 5when a continuous-shooting picture is photoed in the electronic "still" camera 30after processing of amplification etc. is performed by the amplifying circuit 32in the coding circuit 33compression processing of the audio signal inputted into the built-in microphone 31 is carried out. At this timethe adaptive prediction-coding method (ADPCM) providedfor example in the standard G726 of the Consulting Committee of International Telegraph & Telephone (CCITT) is adopted as a coding mode.

[0046]In this waythe processed audio signal is recorded on the application (APP) field or comment (COM) field of the corresponding JPEG data of a picture (picture of the head of a continuous-shooting picture). Since it is coded by 32K bit per second in an ADPCM systemthe sound by 32 seconds is recordable on APP and COM (both a maximum of 65533 bytes)respectively.

[0047]In this waythe voice data recorded on the memory card 34 which is a

recording medium of the electronic "still" camera 30 is changed as an incidental sound of dynamic image data in coding equipment. That isin drawing 6the inputted audio signal is compressed according to the voice encoding system which is restored to a fundamental tone voice signal by the ADPCM decoder circuit 40and is specified with the MPEG system in the coding circuit 41. This method performs quantization based on people's aural characteristic for every frequency bandafter carrying out orthogonal transformation to an audio signal.

[0048]And in the format circuit 42it acts to a picture signal as MultiplexThe continuous-shooting image data and voice data which were changed into the dynamic image signal by the technique explained previously are constituted by the packetand the time stamp signal "TS" showing corresponding time is recorded on the header area of this packet.

[0049]It acts as Multiplex of the corresponding picture data packet and voice data packet of timeand they constitute a pack. In this wayvideo and an audio signal synchronize with a time stampand it is reproduced. The composition of this data pack is as being shown in drawing 7.

[0050]As explained abovesince the image data and voice data which are obtained by an electronic "still" camera are convertible for highly efficient video coding datain the 2nd exampleit can use effectively.

[0051]As explained in full detail abovein the coding equipment of this inventionthe video coded as continuation of a still picture is convertible for the coding mode using inter frame compression. Since it changes using the coding data and decoding data of a basisit is convertible highly efficiently and at high speed.

[0052]

[Effect of the Invention]According to this inventiondata conversion corresponding to the data of a different method can be made possibleand the coding equipment which performs editreproductionrecord to a common mediumetc. can be provided.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the composition of the 1st example of the coding equipment of this invention.

[Drawing 2]It is a figure for explaining the coding mode of a picture.

[Drawing 3]It is a figure showing the composition of the 2nd example of the coding equipment of this invention.

[Drawing 4]It is a figure for explaining the coding mode of a picture.

[Drawing 5]It is a figure for explaining an audio coding mode.

[Drawing 6]It is a figure for explaining an audio coding mode.

[Drawing 7]It is a figure showing the data configuration of a picture and a sound.

[Description of Notations]

1 [-- Inverse quantization IDCT circuit] -- An input terminal2 -- An IVLC circuit3 -- Data memory4 5 [-- A motion vector calculation circuit 9 / -- A

selector10 / -- A subtractor circuit11 / -- A DCT quantization circuit12 / -- A code amount prediction circuit13 / -- VLC circuit.] -- A buffer memory6 -- A coefficient decision circuit7 -- A difference decision circuit8